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# MUSKEGON LAKE, MUSKEGON COUNTY, MICHIGAN

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Michigan Department of Natural Resources
Michigan National Guard

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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# REPORT
# ON
# MUSKEGON LAKE
# MUSKEGON COUNTY
# MICHIGAN

EPA REGION V

WORKING PAPER No. 203

WITH THE COOPERATION OF THE

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

AND THE

MICHIGAN NATIONAL GUARD

FEBRUARY, 1975

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# FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

## OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

## ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

## LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Michigan Department of Natural Resources for professional involvement and to the Michigan National Guard for conducting the tributary sampling phase of the Survey.

A. Gene Gazlay, former Director, and David H. Jenkins, Acting Director, Michigan Department of Natural Resources; and Carlos Fetterolf, Chief Environmental Scientist, and Dennis Tierney, Aquatic Biologist, Bureau of Water Management, Department of Natural Resources, provided invaluable lake documentation and counsel during the course of the Survey. John Vogt, Chief of the Bureau of Environmental Health, Michigan Department of Public Health, and his staff were most helpful in identfying point sources and soliciting municipal participation in the Survey.

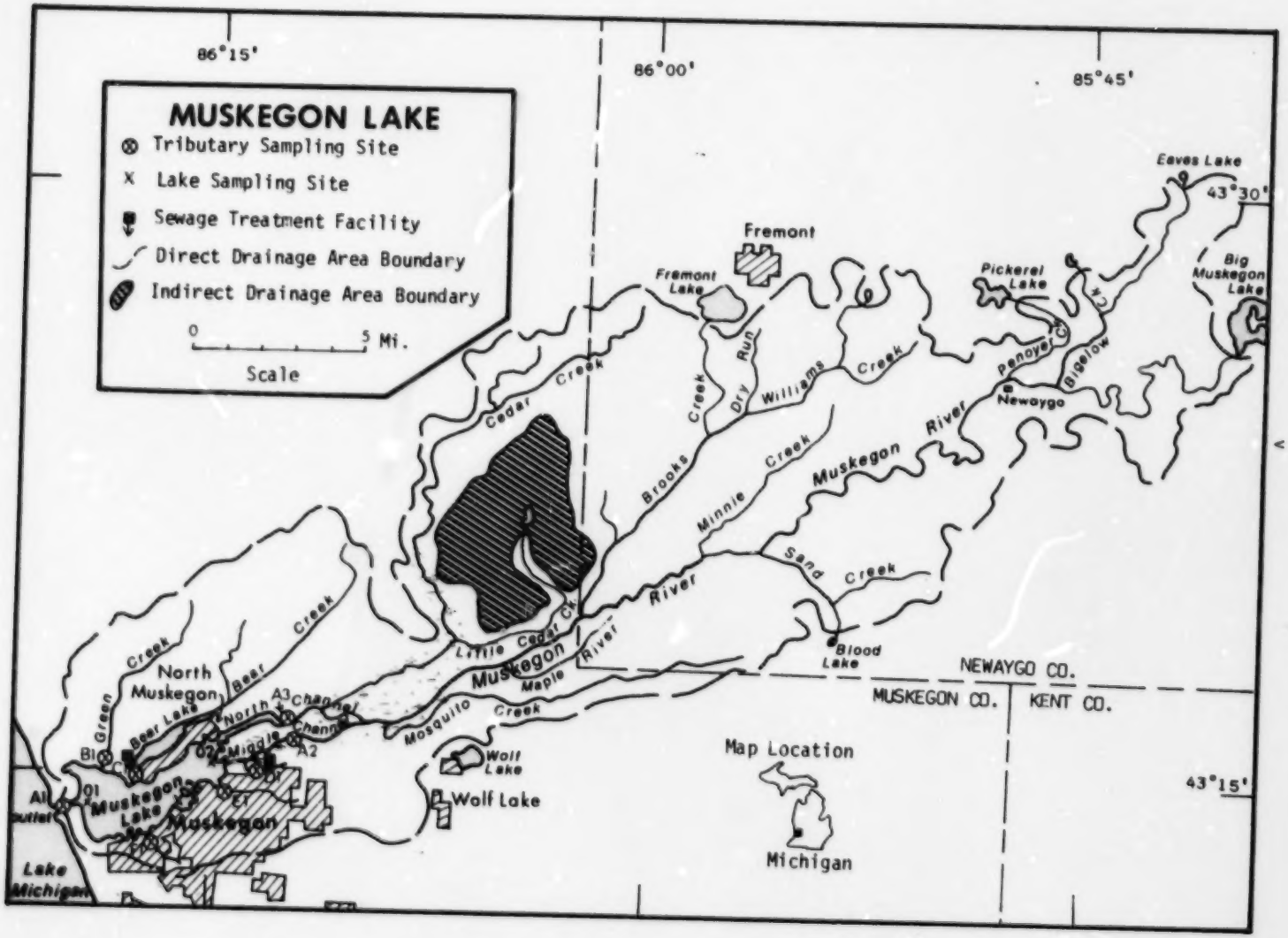
Major General Clarence A. Schnipke (Retired), then the Adjutant General of Michigan, and Project Officer Colonel Albert W. Lesky, who directed the volunteer efforts of the Michigan National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MICHIGAN

| LAKE NAME | COUNTY |
|---|---|
| Allegan Res. | Allegan |
| Barton | Kalamazoo |
| Belleville | Wayne |
| Betsie | Benzie |
| Brighton | Livingston |
| Caro Res. | Tuscola |
| Charlevoix | Charlevoix |
| Chemung | Livingston |
| Constantine Res. | St. Joseph |
| Crystal | Montcalm |
| Deer | Marquette |
| Ford | Washtenaw |
| Fremont | Newago |
| Higgins | Roscommon |
| Holloway Res. | Genesee, Lapeer |
| Houghton | Roscommon |
| Jordon | Ionia, Barry |
| Kent | Oakland |
| Long | St. Joseph |
| Macatawa | Ottawa |
| Manistee | Manistee |
| Mona | Muskegon |
| Muskegon | Muskegon |
| Pentwater | Oceana |
| Pere Marquette | Mason |
| Portage | Houghton |
| Randall | Branch |
| Rogers Pond | Mecosta |
| Ross | Gladwin |
| St. Louis Res. | Gratiot |
| Sanford | Midland |
| Strawberry | Livingston |
| Thompson | Livingston |
| Thornapple | Barry |
| Union | Branch |
| White | Muskegon |


MUSKEGON LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Direct Drainage Area Boundary
Indirect Drainage Area Boundary
0
5 Mi.
Scale
86°15'
86°00'
85°45'
43°30'
43°15'
Eaves Lake
Fremont
Fremont Lake
Pickerel Lake
Big Muskegon Lake
Newaygo
Cedar Creek
Dry Run Creek
Williams Creek
Penoyer Creek
Bigelow Creek
Brooks Creek
Minnie Creek
Muskegon River
Sand Creek
Little Cedar Ck
Muskegon River
Blood Lake
NEWAYGO CO.
MUSKEGON CO.
KENT CO.
North Muskegon
Green Creek
Bear Creek
Bear Lake
North Channel
Maple
Mosquito Creek
Wolf Lake
Wolf Lake
Muskegon Lake
Muskegon
Lake Michigan
Map Location
Michigan

# MUSKEGON LAKE

## STORET NO. 2659

## I. CONCLUSIONS

### A. Trophic Condition:

Survey data show that Muskegon Lake is eutrophic. Of the 35 Michigan lakes sampled in November when essentially all were well-mixed, 21 had less mean total phosphorus, 19 had less mean dissolved phosphorus, and 14 had less mean inorganic nitrogen; of the 41 Michigan lakes sampled, ten had less mean chlorophyll a, but 16 had greater Secchi disc transparency*. Ketelle and Uttormark (1971) report that excessive weed growths and algal blooms are problems at this lake.

### B. Rate-Limting Nutrient:

The results of the algal assay show that Muskegon Lake was nitrogen limited at the time the sample was collected (09/19/72). The lake data indicate nitrogen limitation at the other sampling times as well (N/P ratios were 11/1 or less, and nitrogen limitation would be expected).

### C. Nutrient Controllability:

1. Point sources--During the sampling year, Muskegon Lake received a total phosphorus load at a rate more than three times the rate proposed by Vollenweider as "dangerous"; i.e., a eutrophic rate (see page 13). However, the hydraulic retention time

* See Appendix A.

of Muskegon Lake is a relatively short 23 days, and Vollenweider's model may not be applicable.

Sewage effluents from the cities of Muskegon and Roosevelt Park as well as industrial wastes (not measured or estimated in this study) were diverted to a cropland spray-irrigation management system that became operational in May, 1973 (Bastian, 1974).

The phosphorus loads from the municipal point sources noted above amounted to about 7% of the total load during the sampling year. After diversion, it is calculated that the loading rate was reduced to 4.4 $g/m^2/yr$ or about twice the eutrophic rate. However, since the applicability of Vollenweider's model is questionable, and since unmeasured industrial nutrient loads were also diverted, it is believed the trophic condition of Muskegon Lake will improve significantly once a new phosphorus equilibrium is attained.

2. Non-point sources--During the sampling year, it is estimated that non-point sources, including precipitation, contributed about 65% of the total phosphorus load to Muskegon Lake.

Except for the Muskegon River and Green Creek, the phosphorus exports of the Muskegon Lake tributaries were unusually high, especially the smaller Four Mile, Ryerson, and Ruddiman creeks

drainages (see page 13). It is probable that the high exports of the latter streams are due to urban drainage.

## II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

### A. Lake Morphometry†:

1. Surface area: 4,150 acres.
2. Mean depth: 23.5 feet.
3. Maximum depth: 69 feet.
4. Volume: 97,525 acre-feet.
5. Mean hydraulic retention time: 23 days.

### B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

| Name | Drainage area* | Mean flow* |
|---|---|---|
| Muskegon River | 2,567.0 $mi^2$ | 2,078.7 cfs |
| Green Creek | 11.7 $mi^2$ | 11.8 cfs |
| Bear Lake outlet | 28.6 $mi^2$ | 29.5 cfs |
| Four Mile Creek | 3.4 $mi^2$ | 3.1 cfs |
| Ryerson Creek | 7.6 $mi^2$ | 7.1 cfs |
| Ruddiman Creek | 3.4 $mi^2$ | 3.1 cfs |
| Minor tributaries & immediate drainage - | 5.8 $mi^2$ | 9.7 cfs |
| Totals | 2,627.5 $mi^2$ | 2,143.0 cfs |

2. Outlet -

| | | |
|---|---|---|
| Muskegon River | 2,634.0 $mi^2$** | 2,143.0 cfs |

### C. Precipitation***:

1. Year of sampling: 31.8 inches.
2. Mean annual: 30.2 inches.

† Fetterolf, 1973.
* Drainage areas are accurate within ±5%; mean daily flows for 74% of the sampling sites are accurate within ±25% and the remaining sites up to ±40%; and mean monthly flows, normalized mean monthly flows, and mean annual flows are slightly more accurate than mean daily flows.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods, 1972".

## III. LAKE WATER QUALITY SUMMARY

Muskegon Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (15 feet to surface) sample was composited from the three stations for phytoplankton identification and enumeration; and during the second visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analyses. The maximum depths sampled were 44 feet at station 1, 31 feet at station 2, and 59 feet at station 3.

The results obtained are presented in full in Appendix C, and the data for the fall sampling period, when the lake essentially was well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix C.

A. Physical and chemical characteristics:

| Parameter | Minimum | Mean | Median | Maximum |
|---|---|---|---|---|
| | | FALL VALUES (11/14/72) | | |
| Temperature (Cent.) | 7.1 | 7.4 | 7.5 | 7.5 |
| Dissolved oxygen (mg/l) | 9.4 | 9.7 | 9.6 | 10.1 |
| Conductivity (μmhos) | 330 | 365 | 370 | 380 |
| pH (units) | 7.7 | 7.7 | 7.7 | 7.8 |
| Alkalinity (mg/l) | 142 | 148 | 147 | 164 |
| Total P (mg/l) | 0.046 | 0.087 | 0.059 | 0.530 |
| Dissolved P (mg/l) | 0.035 | 0.043 | 0.039 | 0.059 |
| $NO_2$ + $NO_3$ (mg/l) | 0.150 | 0.186 | 0.160 | 0.600 |
| Ammonia (mg/l) | 0.210 | 0.283 | 0.220 | 1.210 |
| | | ALL VALUES | | |
| Secchi disc (inches) | 60 | 64 | 62 | 72 |

B. Biological characteristics:

1. Phytoplankton* -

| Sampling Date | Dominant Genera | Number per ml |
|---|---|---|
| 09/19/72 | 1. Melosira | 1,525 |
| | 2. Anabaena | 506 |
| | 3. Flagellates | 145 |
| | 4. Stephanodiscus | 145 |
| | 5. Marssionella | 126 |
| | Other genera | 597 |
| | Total | 3,044 |
| 11/14/72 | 1. Lyngbya | 2,132 |
| | 2. Oscillatoria | 675 |
| | 3. Dinobryon | 229 |
| | 4. Microcystis | 193 |
| | 5. Anabaena | 157 |
| | Other genera | 613 |
| | Total | 3,999 |

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

| Sampling Date | Station Number | Chlorophyll a (µg/l) |
|---|---|---|
| 06/13/72 | 01 | 13.0 |
| | 02 | 17.9 |
| | 03 | 28.1 |
| 09/19/72 | 01 | 8.8 |
| | 02 | 3.7 |
| | 03 | 10.0 |
| 11/14/72 | 01 | 2.5 |
| | 02 | 0.5 |
| | 03 | 1.1 |

* The June sample was lost in shipment.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

| Spike (mg/l) | Ortho P Conc. (mg/l) | Inorganic N Conc. (mg/l) | Maximum yield (mg/l-dry wt.) |
|---|---|---|---|
| Control | 0.055 | 0.238 | 7.3 |
| 0.010 P | 0.065 | 0.238 | 7.4 |
| 0.020 P | 0.075 | 0.238 | 7.4 |
| 0.050 P | 0.105 | 0.238 | 7.2 |
| 0.050 P + 5.0 N | 0.105 | 5.238 | 35.8 |
| 0.050 P + 10.0 N | 0.105 | 10.238 | 37.9 |
| 10.0 N | 0.105 | 10.238 | 14.0 |

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Muskegon Lake was high at the time the assay sample was collected. Also, the lack of significant increase in yields with increasing increments of orthophosphorus, until nitrogen was also added, indicates that the lake was limited by nitrogen at sampling time (09/19/72). Note that the addition of only nitrogen resulted in a yield much greater than the control yield.

The lake data further substantiate nitrogen limitation. On all occasions, the nitrogen to phosphorus ratios were less than 11 to 1.

## IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Michigan National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April, June, and July when two samples were collected. Sampling was begun in October, 1972, and was completed in September, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Michigan District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loadings for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the means of the nutrient loads, in lbs/mi$^2$/year, at stations B-1, C-1, D-1, E-1, and F-1 and multiplying the means by the ZZ area in mi$^2$.

Nutrient loads for the cities of Muskegon and Roosevelt Park were estimated at 2.5 lbs P and 7.5 lbs N/capita/year. The diversion of the municipal and industrial wastes of Muskegon and Roosevelt Park was instituted in May, 1973, when a cropland spray-irrigation wastewater management system began pumping wastewater to aeration and storage lagoons (Bastian, 1974). The estimated nutrient loads from the above

* See Working Paper No. 1.

communities were adjusted for this diversion and represent the loads for eight months of the sampling year.

A. Waste Sources:

1. Known municipal -

| Name | Pop. Served | Treatment | Mean Flow (mgd) | Receiving Water |
|---|---|---|---|---|
| Muskegon | 51,081 | (land disp.) | 8.700 | Muskegon Lake |
| Roosevelt Park | 2,578 | (land disp.) | 0.600 | Muskegon Lake |

2. Industrial - Unknown

* Bastian, 1973.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| Source | lbs P/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Muskegon River | 152,680 | 60.1 |
| Green Creek | 640 | 0.3 |
| Bear Lake outlet | 3,370 | 1.3 |
| Four Mile Creek | 1,680 | 0.7 |
| Ryerson Creek | 2,410 | 0.9 |
| Ruddiman Creek | 1,350 | 0.5 |
| b. Minor tributaries & immediate drainage (non-point load) - | 1,590 | 0.6 |
| c. Known municipal STP's - | | |
| Muskegon | 85,140 | 33.5 |
| Roosevelt Park | 4,300 | 1.7 |
| d. Septic tanks* - | 100 | <0.1 |
| e. Known industrial - Unknown | - | - |
| f. Direct precipitation** - | 650 | 0.3 |
| Total | 253,910 | 100.0 |

2. Outputs -

Lake outlet - Muskegon River 250,690

3. Net annual P accumulation - 3,220 pounds

* Estimate based on 151 shoreline dwellings and one State park; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

| Source | lbs N/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Muskegon River | 3,613,530 | 88.0 |
| Green Creek | 24,630 | 0.6 |
| Bear Lake outlet | 73,530 | 1.8 |
| Four Mile Creek | 9,100 | 0.2 |
| Ryerson Creek | 37,410 | 0.9 |
| Ruddiman Creek | 15,420 | 0.4 |
| b. Minor tributaries & immediate drainage (non-point load) - | 19,500 | 0.5 |
| c. Known municipal STP's - | | |
| Muskegon | 255,400 | 6.2 |
| Roosevelt Park | 12,890 | 0.3 |
| d. Septic tanks* - | 3,630 | 0.1 |
| e. Known industrial - Unknown | - | - |
| f. Direct precipitation** - | 39,980 | 1.0 |
| Total | 4,105,020 | 100.0 |

2. Outputs -

Lake outlet - Muskegon River 3,942,810

3. Net annual accumulation - 162,210 pounds

* Estimate based on 151 shoreline dwellings and one State park; see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

| Tributary | lbs P/mi$^2$/yr | lbs N/mi$^2$/yr |
|---|---|---|
| Muskegon River | 59 | 1,408 |
| Green Creek | 55 | 2,105 |
| Bear Lake outlet | 118 | 2,571 |
| Four Mile Creek | 494 | 2,676 |
| Ryerson Creek | 317 | 4,922 |
| Ruddiman Creek | 397 | 4,535 |

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with very short hydraulic retention times.

| | Total Phosphorus | | Total Nitrogen | |
|---|---|---|---|---|
| Units | Total | Accumulated | Total | Accumulated |
| lbs/acre/yr | 61.2 | 0.8 | 989.2 | 39.1 |
| grams/m$^2$/yr | 6.86 | 0.09 | 110.9 | 4.4 |

Vollenweider loading rates for phosphorus (g/m$^2$/yr) based on mean depth and mean hydraulic retention time of Muskegon Lake:

| | |
|---|---|
| "Dangerous" (eutrophic rate) | 2.00 |
| "Permissible" (oligotrophic rate) | 1.00 |

## V. LITERATURE REVIEWED

Bastian, Robert K., 1973. Project status and research at Muskegon, Michigan. Symp. on Land Treatment of Secondary Effluent, Boulder, CO, November 8-9.

_____, 1974. Personal communication (Muskegon County wastewater treatment-irrigation system). U.S. EPA Proj. Support Off., Res. & Monitoring, Muskegon.

Fetterolf, Carlos, 1973. Personal communication (lake morphometry). MI Dept. Nat. Resources, Lansing.

Vollenweider, Richard A. (in press). Input-output models. Schweiz. Z. Hydrol.

# VI. APPENDICES

## APPENDIX A

## LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | FALL VALUES MEAN TOTAL P | FALL VALUES MEAN DISS P | FALL VALUES MEAN INORG N | ALL VALUES SEC-MEAN SEC | ALL VALUES MEAN CHLORA | ALL VALUES IS-MIN DO |
|---|---|---|---|---|---|---|---|
| 2640 | HOLLOWAY RESERVOIR | 0.062 | 0.043 | 1.461 | 439.375 | 10.678 | 9.200 |
| 2641 | CARO RESERVOIR | 0.117 | 0.022 | 3.035 | 473.000 | 11.967 | 9.500 |
| 2642 | BOARDMAN HYDRO POND | 0.006 | 0.005 | 0.358 | 363.500 | 1.267 | 6.600 |
| 2643 | ALLEGAN LAKE | 0.123 | 0.057 | 1.166 | 470.222 | 20.311 | 12.600 |
| 2646 | BARTON LAKE | 0.121 | 0.086 | 1.489 | 456.167 | 27.680 | 14.650 |
| 2649 | BELLEVILLE LAKE | 0.110 | 0.048 | 1.428 | 465.250 | 28.262 | 8.200 |
| 2650 | BETSIE LAKE | 0.025 | 0.008 | 0.273 | 461.667 | 4.567 | 7.400 |
| 2653 | BRIGHTON LAKE | 0.109 | 0.073 | 1.015 | 456.000 | 44.233 | 7.500 |
| 2657 | LAKE CHARLEVOIX | 0.007 | 0.006 | 0.230 | 351.250 | 3.008 | 9.240 |
| 2658 | LAKE CHEMUNG | 0.044 | 0.014 | 0.132 | 404.333 | 13.483 | 14.800 |
| 2661 | CONSTANTINE RESERVOIR | 0.027 | 0.008 | 0.910 | 456.167 | 39.317 | 7.500 |
| 2669 | FORD LAKE | 0.185 | 0.058 | 1.536 | 456.167 | 14.733 | 14.000 |
| 2671 | FREMONT LAKE | 0.372 | 0.342 | 1.406 | 441.667 | 28.500 | 14.600 |
| 2680 | JORDAN LAKE | 0.188 | 0.144 | 1.998 | 427.667 | 20.517 | 14.900 |
| 2683 | KENT LAKE | 0.040 | 0.015 | 0.417 | 455.000 | 33.944 | 13.000 |
| 2688 | LAKE MACATAWA | 0.197 | 0.120 | 2.358 | 477.600 | 25.600 | 12.200 |
| 2689 | MANISTEE LAKE | 0.010 | 0.010 | 0.304 | 451.333 | 6.317 | 11.300 |
| 2699 | MUSKEGON LAKE | 0.007 | 0.003 | 0.409 | 430.444 | 9.511 | 14.600 |
| 2705 | PENTWATER LAKE | 0.027 | 0.017 | 0.496 | 430.667 | 16.093 | 14.600 |
| 2711 | RANDALL LAKE | 0.246 | 0.183 | 0.818 | 497.333 | 27.217 | 8.020 |
| 2712 | ROGERS POND | 0.026 | 0.015 | 0.183 | 435.500 | 8.133 | 9.600 |
| 2713 | RUSS RESERVOIR | 0.034 | 0.021 | 0.460 | 465.333 | 10.383 | 8.200 |
| 2714 | SANFORD LAKE | 0.016 | 0.008 | 0.387 | 458.750 | 13.791 | 8.300 |
| 2723 | THORNAPPLE LAKE | 0.042 | 0.032 | 1.737 | 442.833 | 14.650 | 10.000 |
| 2725 | UNION LAKE | 0.083 | 0.064 | 1.252 | 455.500 | 15.667 | 8.200 |
| 2728 | WHITE LAKE | 0.027 | 0.019 | 0.367 | 417.778 | 9.211 | 13.400 |
| 2731 | MONA LAKE | 0.307 | 0.241 | 0.963 | 451.667 | 27.783 | 14.100 |
| 2732 | LONG LAKE | 0.163 | 0.148 | 0.749 | 418.400 | 10.867 | 13.600 |

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | FALL VALUES: MEAN TOTAL P | FALL VALUES: MEAN DISS P | FALL VALUES: MEAN INURG N | ALL VALUES: 500- MEAN SEC | ALL VALUES: MEAN CHLORA | ALL VALUES: 15- MIN DO* |
|---|---|---|---|---|---|---|---|
| 2693 | ST LOUIS RESERVOIR | 0.134 | 0.093 | 1.227 | 462.667 | 5.583 | 8.420 |
| 2694 | CRYSTAL LAKE | 0.009 | 0.006 | 0.164 | 380.000 | 2.986 | 13.000 |
| 2695 | HIGGINS LAKE | 0.007 | 0.005 | 0.058 | 268.500 | 1.043 | 9.400 |
| 2696 | HOUGHTON LAKE | 0.018 | 0.008 | 0.136 | 420.833 | 9.217 | 8.200 |
| 2697 | THOMPSON LAKE | 0.043 | 0.029 | 0.436 | 407.889 | 11.967 | 14.800 |
| 2698 | PERE MARQUETTE LAKE | 0.032 | 0.024 | 0.346 | 448.667 | 11.833 | 8.600 |
| 2699 | STRAWBERRY LAKE | 0.069 | 0.050 | 0.567 | 419.800 | 11.117 | 13.600 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | FALL VALUES: MEAN TOTAL P | FALL VALUES: MEAN DISS P | FALL VALUES: MEAN INORG N | ALL VALUES: SEC-MEAN SEC | ALL VALUES: MEAN CHLORA | ALL VALUES: 1S-MIN DO | INDEX NO |
|---|---|---|---|---|---|---|---|---|
| 2640 | HOLLOWAY RESERVOIR | 46 ( 16) | 43 ( 15) | 17 ( 6) | 57 ( 20) | 60 ( 21) | 63 ( 22) | 206 |
| 2641 | CAMO RESERVOIR | 29 ( 10) | 54 ( 19) | 0 ( 0) | 3 ( 1) | 49 ( 17) | 54 ( 19) | 189 |
| 2642 | MOAHOMAN HYDRO POND | 97 ( 34) | 97 ( 34) | 69 ( 24) | 91 ( 32) | 94 ( 33) | 97 ( 34) | 545 |
| 2603 | ALLEGAN LAKE | 20 ( 7) | 31 ( 11) | 31 ( 11) | 6 ( 2) | 29 ( 10) | 40 ( 14) | 157 |
| 2606 | BARTON LAKE | 23 ( 8) | 20 ( 7) | 14 ( 5) | 29 ( 9) | 14 ( 5) | 3 ( 1) | 103 |
| 2609 | BELLEVILLE LAKE | 26 ( 9) | 37 ( 13) | 20 ( 7) | 11 ( 4) | 11 ( 4) | 79 ( 26) | 184 |
| 2610 | BETSIE LAKE | 77 ( 27) | 77 ( 27) | 60 ( 20) | 17 ( 6) | 86 ( 30) | 94 ( 33) | 431 |
| 2613 | BRIGHTON LAKE | 31 ( 11) | 23 ( 8) | 34 ( 12) | 34 ( 12) | 0 ( 0) | 90 ( 31) | 212 |
| 2617 | LAKE CHARLEVOIX | 91 ( 32) | 91 ( 32) | 83 ( 29) | 94 ( 33) | 89 ( 31) | 60 ( 21) | 508 |
| 2618 | LAKE CHEMUNG | 49 ( 17) | 71 ( 25) | 94 ( 33) | 86 ( 30) | 46 ( 16) | 11 ( 2) | 357 |
| 2621 | CONSTANTINE RESERVOIR | 71 ( 25) | 83 ( 29) | 40 ( 14) | 29 ( 9) | 3 ( 1) | 90 ( 31) | 316 |
| 2629 | FORD LAKE | 34 ( 12) | 29 ( 10) | 11 ( 4) | 29 ( 9) | 37 ( 13) | 23 ( 8) | 163 |
| 2631 | FREMONT LAKE | 0 ( 0) | 0 ( 0) | 23 ( 8) | 54 ( 19) | 9 ( 3) | 11 ( 2) | 97 |
| 2640 | JORDAN LAKE | 11 ( 4) | 11 ( 4) | 6 ( 2) | 69 ( 24) | 26 ( 9) | 0 ( 0) | 123 |
| 2643 | KENT LAKE | 57 ( 20) | 69 ( 24) | 63 ( 22) | 40 ( 14) | 6 ( 2) | 36 ( 12) | 271 |
| 2648 | LAKE MACATAWA | 9 ( 3) | 14 ( 5) | 3 ( 1) | 0 ( 0) | 23 ( 8) | 43 ( 15) | 92 |
| 2649 | MANISTEE LAKE | 80 ( 28) | 74 ( 26) | 77 ( 27) | 46 ( 16) | 80 ( 28) | 46 ( 16) | 403 |
| 2659 | MUSKEGON LAKE | 37 ( 13) | 40 ( 14) | 54 ( 19) | 60 ( 21) | 69 ( 24) | 11 ( 2) | 271 |
| 2665 | PENTWATER LAKE | 69 ( 24) | 63 ( 22) | 51 ( 18) | 66 ( 23) | 31 ( 11) | 11 ( 2) | 291 |
| 2671 | RANDALL LAKE | 6 ( 2) | 6 ( 2) | 43 ( 15) | 23 ( 8) | 20 ( 7) | 86 ( 30) | 184 |
| 2672 | ROGERS POND | 74 ( 26) | 66 ( 23) | 86 ( 30) | 63 ( 22) | 77 ( 27) | 51 ( 18) | 417 |
| 2673 | ROSS RESERVOIR | 60 ( 21) | 57 ( 20) | 57 ( 20) | 9 ( 3) | 63 ( 22) | 79 ( 26) | 325 |
| 2674 | SANFORD LAKE | 86 ( 30) | 80 ( 28) | 74 ( 26) | 20 ( 7) | 43 ( 15) | 71 ( 25) | 374 |
| 2683 | THORNAPPLE LAKE | 54 ( 19) | 46 ( 16) | 9 ( 3) | 51 ( 18) | 40 ( 14) | 49 ( 17) | 249 |
| 2685 | UNION LAKE | 40 ( 14) | 26 ( 9) | 26 ( 9) | 37 ( 13) | 34 ( 12) | 79 ( 26) | 242 |
| 2688 | WHITE LAKE | 66 ( 23) | 60 ( 21) | 66 ( 23) | 80 ( 28) | 74 ( 26) | 31 ( 11) | 377 |
| 2691 | NONA LAKE | 3 ( 1) | 3 ( 1) | 37 ( 13) | 43 ( 15) | 17 ( 6) | 20 ( 7) | 123 |
| 2692 | LONG LAKE | 14 ( 5) | 9 ( 3) | 46 ( 16) | 77 ( 27) | 66 ( 23) | 27 ( 9) | 239 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | ---------FALL VALUES---------- MEAN TOTAL P | MEAN DISS P | MEAN INORG N | ----------ALL VALUES--------- 500- MEAN SEC | MEAN CHLORA | 15- MIN DO | INDEX NO |
|---|---|---|---|---|---|---|---|---|
| 2693 | ST LOUIS RESERVOIR | 17 ( 6) | 17 ( 6) | 29 ( 10) | 14 ( 5) | 83 ( 29) | 69 ( 24) | 229 |
| 2694 | CRYSTAL LAKE | 89 ( 31) | 89 ( 31) | 89 ( 31) | 89 ( 31) | 91 ( 32) | 36 ( 12) | 483 |
| 2695 | HIGGINS LAKE | 94 ( 33) | 94 ( 33) | 97 ( 34) | 97 ( 34) | 97 ( 34) | 57 ( 20) | 536 |
| 2696 | HOUGHTON LAKE | 83 ( 29) | 86 ( 30) | 91 ( 32) | 71 ( 25) | 71 ( 25) | 79 ( 26) | 481 |
| 2697 | THOMPSON LAKE | 51 ( 18) | 49 ( 17) | 60 ( 21) | 83 ( 29) | 51 ( 18) | 11 ( 2) | 305 |
| 2698 | PERE MARQUETTE LAKE | 63 ( 22) | 51 ( 18) | 71 ( 25) | 49 ( 17) | 54 ( 19) | 66 ( 23) | 354 |
| 2699 | STRAWBERRY LAKE | 43 ( 15) | 34 ( 12) | 49 ( 17) | 74 ( 26) | 57 ( 20) | 27 ( 9) | 284 |

# APPENDIX B

## TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MICHIGAN 2/3/75

LAKE CODE 2659 MUSKEGON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ MI) 2634.00

| TRIBUTARY | SUB-DRAINAGE AREA(SQ MI) | NORMALIZED FLOWS(CFS) JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2659A1 | 2634.00 | 2019.40 | 2182.30 | 3244.40 | 3740.10 | 2715.90 | 2091.40 | 1515.80 | 1284.00 | 1354.90 | 1608.70 | 1984.40 | 1998.40 | 2143.05 |
| 2659A2 | 1283.00 | 878.00 | 948.00 | 1416.00 | 1626.00 | 1192.00 | 917.00 | 666.00 | 564.00 | 595.00 | 702.00 | 864.00 | 866.00 | 935.36 |
| 2659A3 | 1284.00 | 1074.00 | 1159.00 | 1733.00 | 1987.00 | 1456.00 | 1121.00 | 813.00 | 690.00 | 728.00 | 858.00 | 1057.00 | 1058.00 | 1143.26 |
| 2659B1 | 11.70 | 12.60 | 13.80 | 18.40 | 20.60 | 12.80 | 9.40 | 6.60 | 5.80 | 6.80 | 9.20 | 12.20 | 14.20 | 11.85 |
| 2659C1 | 28.60 | 34.20 | 39.20 | 46.70 | 48.00 | 29.70 | 24.00 | 16.10 | 12.20 | 12.50 | 23.50 | 31.00 | 37.70 | 29.50 |
| 2659D1 | 3.44 | 3.10 | 3.50 | 4.40 | 5.70 | 3.60 | 2.70 | 1.80 | 1.60 | 1.60 | 2.30 | 3.10 | 3.60 | 3.12 |
| 2659E1 | 7.59 | 6.90 | 7.60 | 10.70 | 12.60 | 8.20 | 6.20 | 4.30 | 4.00 | 4.20 | 5.40 | 7.00 | 8.00 | 7.08 |
| 2659F1 | 3.37 | 3.00 | 3.40 | 4.80 | 5.60 | 3.60 | 2.70 | 1.90 | 1.80 | 1.80 | 2.40 | 3.10 | 3.60 | 3.14 |
| 2659ZZ | 12.00 | 9.00 | 10.00 | 15.00 | 17.00 | 12.00 | 10.00 | 7.00 | 6.00 | 6.00 | 7.00 | 9.00 | 9.00 | 9.74 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 2634.00
SUM OF SUB-DRAINAGE AREAS = 2633.70
TOTAL FLOW IN = 25739.41
TOTAL FLOW OUT = 25739.68

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 2659A1 | 10 | 72 | 1750.00 | 29 | 1820.00 | | | | |
| | 11 | 72 | 2240.00 | | | | | | |
| | 12 | 72 | 2030.00 | 3 | 2350.00 | | | | |
| | 1 | 73 | 910.00 | 7 | 2200.00 | | | | |
| | 2 | 73 | 2910.00 | 4 | 3740.00 | | | | |
| | 3 | 73 | 4990.00 | 4 | 3360.00 | | | | |
| | 4 | 73 | 3410.00 | 6 | 3970.00 | 27 | 2610.00 | | |
| | 5 | 73 | 2460.00 | 15 | 3060.00 | | | | |
| | 6 | 73 | 2490.00 | 3 | 3340.00 | 23 | 1490.00 | | |
| | 7 | 73 | 1650.00 | 10 | 1520.00 | 11 | 1500.00 | 28 | 1450.00 |
| | 8 | 73 | 1480.00 | 27 | 1250.00 | | | | |
| | 9 | 73 | 1240.00 | 29 | 1300.00 | | | | |
| 2659A2 | 10 | 72 | 917.00 | 29 | 941.00 | | | | |
| | 11 | 72 | 1192.00 | | | | | | |
| | 12 | 72 | 1070.00 | 3 | 1260.00 | | | | |
| | 1 | 73 | 2080.00 | 7 | 1170.00 | | | | |
| | 2 | 73 | 1560.00 | 4 | 2000.00 | | | | |
| | 3 | 73 | 2680.00 | 4 | 1730.00 | | | | |
| | 4 | 73 | 1820.00 | 6 | 2130.00 | 27 | 1400.00 | | |
| | 5 | 73 | 1290.00 | 15 | 1640.00 | | | | |
| | 6 | 73 | 1330.00 | 3 | 1770.00 | 23 | 792.00 | | |
| | 7 | 73 | 886.00 | 10 | 805.00 | 11 | 803.00 | 28 | 776.00 |
| | 8 | 73 | 792.00 | 27 | 671.00 | | | | |
| | 9 | 73 | 688.00 | 29 | 732.00 | | | | |

TRIBUTARY FLOW INFORMATION FOR MICHIGAN 2/3/75

LAKE CODE 2659 MUSKEGON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 2659A3 | 10 | 72 | 751.00 | 29 | 770.00 | | | | |
| | 11 | 72 | 976.00 | | | | | | |
| | 12 | 72 | 879.00 | 3 | 1030.00 | | | | |
| | 1 | 73 | 1700.00 | 7 | 958.00 | | | | |
| | 2 | 73 | 1280.00 | 4 | 1630.00 | | | | |
| | 3 | 73 | 2190.00 | 4 | 1420.00 | | | | |
| | 4 | 73 | 1480.00 | 6 | 1740.00 | 27 | 1140.00 | | |
| | 5 | 73 | 1050.00 | 15 | 1340.00 | | | | |
| | 6 | 73 | 1090.00 | 3 | 1450.00 | 23 | 648.00 | | |
| | 7 | 73 | 724.00 | 10 | 662.00 | 11 | 657.00 | 28 | 634.00 |
| | 8 | 73 | 648.00 | 27 | 549.00 | | | | |
| | 9 | 73 | 562.00 | 29 | 598.00 | | | | |
| 2659B1 | 10 | 72 | 1.60 | 29 | 2.40 | | | | |
| | 11 | 72 | 1.80 | | | | | | |
| | 12 | 72 | 1.60 | 3 | 1.50 | | | | |
| | 1 | 73 | 4.30 | 7 | 2.90 | | | | |
| | 2 | 73 | 2.60 | 4 | 3.90 | | | | |
| | 3 | 73 | 4.50 | 4 | 7.80 | | | | |
| | 4 | 73 | 4.00 | 6 | 3.70 | 27 | 2.90 | | |
| | 5 | 73 | 4.30 | 15 | 3.00 | | | | |
| | 6 | 73 | 2.30 | 3 | 3.90 | 23 | 1.60 | | |
| | 7 | 73 | 1.10 | 10 | 1.10 | 11 | 1.00 | 28 | 1.10 |
| | 8 | 73 | 1.10 | 27 | 1.10 | | | | |
| | 9 | 73 | 1.00 | 29 | 1.10 | | | | |
| 2659C1 | 10 | 72 | 40.00 | 29 | 51.00 | | | | |
| | 11 | 72 | 34.00 | | | | | | |
| | 12 | 72 | 40.00 | 3 | 23.00 | | | | |
| | 1 | 73 | 51.00 | 7 | 30.00 | | | | |
| | 2 | 73 | 27.00 | 4 | 42.00 | | | | |
| | 3 | 73 | 46.00 | 4 | 107.00 | | | | |
| | 4 | 73 | 44.00 | 6 | 36.00 | 27 | 27.00 | | |
| | 5 | 73 | 55.00 | 15 | 33.00 | | | | |
| | 6 | 73 | 27.00 | 3 | 53.00 | 23 | 16.00 | | |
| | 7 | 73 | 17.00 | 10 | 18.00 | 11 | 14.00 | 28 | 13.00 |
| | 8 | 73 | 12.00 | 27 | 10.00 | | | | |
| | 9 | 73 | 9.40 | 29 | 11.00 | | | | |
| 2659D1 | 10 | 72 | 1.40 | 29 | 1.90 | | | | |
| | 11 | 72 | 1.50 | | | | | | |
| | 12 | 72 | 1.30 | 3 | 1.20 | | | | |
| | 1 | 73 | 3.80 | 7 | 2.40 | | | | |
| | 2 | 73 | 2.20 | 4 | 3.40 | | | | |
| | 3 | 73 | 4.00 | 4 | 7.30 | | | | |
| | 4 | 73 | 3.60 | 6 | 3.20 | 27 | 2.40 | | |
| | 5 | 73 | 3.80 | 15 | 2.60 | | | | |
| | 6 | 73 | 1.30 | 3 | 1.80 | 23 | 0.90 | | |
| | 7 | 73 | 0.80 | 10 | 0.80 | 11 | 0.80 | 28 | 0.80 |
| | 8 | 73 | 0.90 | 27 | 0.90 | | | | |
| | 9 | 73 | 0.70 | 29 | 0.70 | | | | |

TRIBUTARY FLOW INFORMATION FOR MICHIGAN 2/3/75

LAKE CODE 2659 MUSKEGON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 2659E1 | 10 | 72 | 13.00 | 29 | 17.00 | | | | |
| | 11 | 72 | 13.00 | | | | | | |
| | 12 | 72 | 14.00 | 3 | 9.90 | | | | |
| | 1 | 73 | 19.00 | 7 | 13.00 | | | | |
| | 2 | 73 | 12.00 | 4 | 18.00 | | | | |
| | 3 | 73 | 20.00 | 4 | 35.00 | | | | |
| | 4 | 73 | 18.00 | 6 | 17.00 | 27 | 13.00 | | |
| | 5 | 73 | 19.00 | 15 | 14.00 | | | | |
| | 6 | 73 | 11.00 | 3 | 18.00 | 23 | 7.00 | | |
| | 7 | 73 | 6.50 | 10 | 6.60 | 11 | 5.70 | 28 | 5.50 |
| | 8 | 73 | 5.40 | 27 | 4.90 | | | | |
| | 9 | 73 | 4.60 | 29 | 5.00 | | | | |
| 2659F1 | 10 | 72 | 18.00 | 29 | 24.00 | | | | |
| | 11 | 72 | 18.00 | | | | | | |
| | 12 | 72 | 19.00 | 3 | 13.00 | | | | |
| | 1 | 73 | 27.00 | 7 | 18.00 | | | | |
| | 2 | 73 | 16.00 | 4 | 24.00 | | | | |
| | 3 | 73 | 28.00 | 4 | 49.00 | | | | |
| | 4 | 73 | 25.00 | 6 | 23.00 | 27 | 18.00 | | |
| | 5 | 73 | 27.00 | 15 | 19.00 | | | | |
| | 6 | 73 | 15.00 | 3 | 24.00 | 23 | 9.80 | | |
| | 7 | 73 | 8.80 | 10 | 9.00 | 11 | 7.80 | 28 | 7.60 |
| | 8 | 73 | 7.40 | 27 | 6.80 | | | | |
| | 9 | 73 | 6.30 | 29 | 6.90 | | | | |
| 2659Z2 | 10 | 72 | 10.00 | | | | | | |
| | 11 | 72 | 10.00 | | | | | | |
| | 12 | 72 | 10.00 | | | | | | |
| | 1 | 73 | 20.00 | | | | | | |
| | 2 | 73 | 10.00 | | | | | | |
| | 3 | 73 | 20.00 | | | | | | |
| | 4 | 73 | 20.00 | | | | | | |
| | 5 | 73 | 10.00 | | | | | | |
| | 6 | 73 | 10.00 | | | | | | |
| | 7 | 73 | 10.00 | | | | | | |
| | 8 | 73 | 10.00 | | | | | | |
| | 9 | 73 | 10.00 | | | | | | |

# APPENDIX C

## PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/02/04

265901
43 14 00.0 086 19 00.0
MUSKEGON LAKE
26 MICHIGAN

11EPALES 2111202
5 0030 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00610 NH3-N TOTAL MG/L | 00665 PHOS-TOT MG/L P | 00666 PHOS-DIS MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 72/06/13 | 01 | 35 0000 | 18.2 | 7.8 | 62 | 360 | 8.30 | 127 | 0.040 | 0.060 | 0.058 | 0.044 |
| | 01 | 35 0015 | 17.5 | 7.1 | | 360 | 8.20 | 126 | 0.040 | 0.090 | 0.053 | 0.044 |
| | 01 | 35 0030 | 15.5 | 6.6 | | 360 | 8.15 | 124 | 0.070 | 0.130 | 0.058 | 0.045 |
| 72/09/19 | 11 | 50 0000 | | | 60 | 328 | 8.48 | 130 | 0.020 | 0.050 | 0.048 | 0.037 |
| | 11 | 50 0004 | 20.4 | 9.0 | | 340 | 8.50 | 131 | 0.030 | 0.060 | 0.058 | 0.040 |
| | 11 | 50 0015 | 20.4 | 8.8 | | 340 | 8.45 | 129 | 0.030 | 0.050 | 0.068 | 0.047 |
| | 11 | 50 0022 | 20.3 | 8.6 | | 330 | 8.45 | 129 | 0.030 | 0.060 | 0.066 | 0.051 |
| | 11 | 50 0030 | 20.0 | 8.2 | | 340 | 8.35 | 129 | 0.030 | 0.060 | 0.068 | 0.049 |
| | 11 | 50 0037 | 20.0 | 3.8 | | 330 | 7.80 | 125 | 0.030 | 0.360 | 0.142 | 0.080 |
| | 11 | 50 0044 | 17.7 | 4.0 | | 330 | 7.85 | 127 | 0.030 | 0.360 | 0.100 | 0.063 |
| 72/11/14 | 11 | 25 0000 | | | 72 | 380 | 7.80 | 144 | 0.150 | 0.220 | 0.530 | 0.036 |
| | 11 | 25 0004 | 7.5 | 9.4 | | 370 | 7.80 | 142 | 0.150 | 0.220 | 0.048 | 0.037 |
| | 11 | 25 0015 | 7.5 | 9.5 | | 370 | 7.80 | 147 | 0.150 | 0.220 | 0.046 | 0.037 |
| | 11 | 25 0022 | 7.5 | 9.6 | | 380 | 7.70 | 144 | 0.150 | 0.210 | 0.053 | 0.036 |
| | 11 | 25 0030 | 7.5 | 9.5 | | 380 | 7.70 | 144 | 0.160 | 0.220 | 0.058 | 0.039 |
| | 11 | 25 0044 | 7.5 | 9.6 | | 370 | 7.70 | 144 | 0.160 | 0.220 | 0.059 | 0.037 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 32217 CHLRPHYL A UG/L |
|---|---|---|---|
| 72/06/13 | 01 | 35 0000 | 13.0J |
| 72/09/19 | 11 | 50 0000 | 5.8J |
| 72/11/14 | 11 | 25 0000 | 2.5J |

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 75/02/04

265902
43 14 00.0 086 15 00.0
MUSKEGON LAKE
26 MICHIGAN

11EPALES
5

2111202
0030 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00610 NH3-N TOTAL MG/L | 00665 PHOS-TOT MG/L P | 00666 PHOS-DIS MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 72/06/13 | 02 20 | 0000 | 21.2 | 8.0 | 60 | 340 | 8.10 | 129 | 0.110 | 0.160 | 0.079 | 0.066 |
| | 02 20 | 0015 | 18.5 | 7.4 | | 350 | 8.10 | 127 | 0.100 | 0.150 | 0.080 | 0.066 |
| | 02 20 | 0025 | 15.6 | 3.6 | | 350 | 7.85 | 128 | 0.110 | 0.380 | 0.089 | 0.083 |
| 72/09/19 | 09 25 | 0000 | | | 60 | 345 | 8.00 | 132 | 0.070 | 0.180 | 0.079 | 0.067 |
| | 09 25 | 0004 | 20.0 | 6.4 | | 340 | 8.00 | 132 | 0.080 | 0.180 | 0.090 | 0.068 |
| | 09 25 | 0015 | 20.0 | 5.9 | | 340 | 8.00 | 131 | 0.060 | 0.170 | 0.087 | 0.065 |
| | 09 25 | 0020 | 19.9 | 6.0 | | 345 | 8.00 | 131 | 0.070 | 0.180 | 0.104 | 0.063 |
| | 09 25 | 0025 | 19.5 | 4.2 | | 330 | 7.80 | 134 | 0.040 | 0.270 | 0.096 | 0.058 |
| | 09 25 | 0031 | 19.1 | 4.3 | | 333 | 7.80 | 133 | 0.040 | 0.280 | 0.071 | 0.055 |
| 72/11/14 | 12 25 | 0000 | | | 66 | 380 | 7.80 | 164 | 0.600 | 1.210 | 0.065 | 0.049 |
| | 12 25 | 0004 | 7.4 | 9.9 | | 380 | 7.80 | 149 | 0.170 | 0.230 | 0.065 | 0.051 |
| | 12 25 | 0015 | 7.3 | 9.8 | | 380 | 7.80 | 150 | 0.170 | 0.230 | 0.070 | 0.055 |
| | 12 25 | 0021 | 7.2 | 9.9 | | 380 | 7.80 | 153 | 0.170 | 0.240 | 0.071 | 0.057 |
| | 12 25 | 0028 | 7.1 | 10.1 | | 380 | 7.80 | 151 | 0.190 | 0.240 | 0.077 | 0.059 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 32217 CHLRPHYL A UG/L |
|---|---|---|---|
| 72/06/13 | 02 20 | 0000 | 17.4J |
| 72/09/19 | 09 25 | 0000 | 3.7J |
| 72/11/14 | 12 25 | 0000 | 0.5J |

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 75/02/04

265903
43 14 00.0 086 16 00.0
MUSKEGON LAKE
26 MICHIGAN

11EPALES 2111202
5 0050 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00610 NH3-N TOTAL MG/L | 00665 PHOS-TOT MG/L P | 00666 PHOS-DIS MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 72/06/13 | 15 00 | 0000 | 19.6 | 9.0 | 66 | 355 | 8.30 | 128 | 0.140 | 0.140 | 0.064 | 0.054 |
| | 15 00 | 0015 | 18.1 | 7.0 | | 360 | 8.20 | 127 | 0.090 | 0.130 | 0.059 | 0.050 |
| | 15 00 | 0030 | 16.1 | | | 300 | 7.95 | 125 | 0.060 | 0.150 | 0.052 | 0.027 |
| 72/09/19 | 10 05 | 0000 | | | 66 | 340 | 8.25 | 128 | 0.030 | 0.060 | 0.051 | 0.040 |
| | 10 05 | 0004 | 20.2 | 8.0 | | 335 | 8.25 | 128 | 0.020 | 0.050 | 0.060 | 0.040 |
| | 10 05 | 0015 | 20.0 | 7.4 | | 340 | 8.15 | 127 | 0.030 | 0.060 | 0.062 | 0.042 |
| | 10 05 | 0021 | 20.0 | 7.2 | | 340 | 8.15 | 126 | 0.030 | 0.070 | 0.065 | 0.044 |
| | 10 05 | 0028 | 19.9 | 6.9 | | 340 | 8.10 | 127 | 0.030 | 0.090 | 0.057 | 0.042 |
| | 10 05 | 0035 | 19.4 | 1.8 | | 320 | 7.63 | 125 | 0.040 | 0.490 | 0.089 | 0.073 |
| | 10 05 | 0042 | 17.0 | 1.0 | | 325 | 7.60 | 124 | 0.020 | 0.810 | 0.131 | 0.110 |
| | 10 05 | 0050 | 14.9 | 0.2 | | 308 | 7.45 | 123 | 0.030 | 0.890 | 0.156 | 0.111 |
| | 10 05 | 0059 | 14.2 | 0.4 | | 300 | 7.50 | 123 | 0.030 | 0.900 | 0.149 | 0.111 |
| 72/11/14 | 11 55 | 0000 | | | 66 | 360 | 7.70 | 149 | 0.150 | 0.220 | 0.063 | 0.044 |
| | 11 55 | 0004 | 7.5 | 9.6 | | 360 | 7.70 | 150 | 0.150 | 0.220 | 0.058 | 0.043 |
| | 11 55 | 0015 | 7.5 | 9.6 | | 340 | 7.70 | 152 | 0.160 | 0.230 | 0.066 | 0.043 |
| | 11 55 | 0025 | 7.5 | 9.6 | | 330 | 7.70 | 145 | 0.160 | 0.220 | 0.048 | 0.035 |
| | 11 55 | 0040 | 7.5 | 9.5 | | 330 | 7.70 | 145 | 0.160 | 0.220 | 0.048 | 0.036 |
| | 11 55 | 0054 | 7.4 | 9.6 | | 330 | 7.70 | 147 | 0.170 | 0.240 | 0.047 | 0.036 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 32217 CHLRPHYL A UG/L |
|---|---|---|---|
| 72/06/13 | 15 00 | 0000 | 28.1J |
| 72/09/19 | 10 05 | 0000 | 10.0J |
| 72/11/14 | 11 55 | 0000 | 1.1J |

J VALUE KNOWN TO BE IN ERROR

# APPENDIX D

# TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/24

```
 265VA1          LS265VA1
43 14 00.0 086 20 00.0
MUSKEGON RIVER
26       13 LAKE HARBOR
0/MUSKEGON LAKE
SAMPLE OUTLET CHANNEL BEACHST IN MUSKEGON
11EPALES                2111204
4                       0000 FEET  DEPTH
```

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/24 | 11 40 | | 0.136 | 0.660 | 0.147 | 0.034 | 0.075 |
| 72/12/03 | 10 40 | | 0.197 | 0.890 | 0.132 | 0.042 | 0.072 |
| 73/01/07 | 10 50 | | 0.330 | 0.640 | 0.120 | 0.040 | 0.072 |
| 73/02/04 | 09 35 | | 0.370 | 0.540 | 0.051 | 0.029 | 0.060 |
| 73/03/04 | 10 00 | | 0.350 | 0.700 | 0.105 | 0.033 | 0.070 |
| 73/04/06 | 16 25 | | 0.260 | 0.630 | 0.050 | 0.023 | 0.060 |
| 73/04/27 | 10 50 | | 0.082 | 0.760 | 0.026 | 0.017 | 0.057 |
| 73/05/15 | 09 00 | | 0.048 | 0.660 | 0.011 | 0.006 | 0.060 |
| 73/06/03 | 11 00 | | 0.010K | 1.000 | 0.037 | 0.014 | 0.060 |
| 73/06/23 | 16 10 | | 0.011 | 0.966 | 0.00K | 0.011 | 0.050 |
| 73/07/10 | 10 50 | | 0.022 | 1.680 | 0.038 | 0.007 | 0.035 |
| 73/07/28 | 08 30 | | 0.080 | 0.740 | 0.018 | 0.012 | 0.037 |
| | 15 00 | | 0.072 | 0.630 | 0.054 | 0.020 | 0.045 |
| 73/09/29 | 09 30 | | 0.058 | 0.460 | 0.056 | 0.010 | 0.050 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2659A2 L52659A2
43 16 00.0 086 12 30.0
MUSKEGON RIVER
26 15 TWIN LAKE
1/MUSKEGON LAKE
MIDDLE CHANNEL N EDGE OF MUSKEGON
11EPALES 211204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 10 15 | | 0.169 | 0.575 | 0.050 | 0.012 | 0.047 |
| 72/12/03 | 10 05 | | 0.210 | 0.440 | 0.031 | 0.014 | 0.028 |
| 73/01/07 | 13 35 | | 0.513 | 0.630 | 0.038 | 0.016 | 0.028 |
| 73/02/04 | 09 00 | | 0.430 | 0.460 | 0.040 | 0.01K | 0.035 |
| 73/03/04 | 09 15 | | 0.430 | 0.630 | 0.066 | 0.020 | 0.055 |
| 73/04/06 | 14 00 | | 0.136 | 0.460 | 0.024 | 0.008 | 0.020 |
| 73/04/27 | 09 50 | | 0.066 | 0.540 | 0.008 | 0.008 | 0.030 |
| 73/05/15 | 09 40 | | 0.113 | 0.560 | 0.008 | 0.005K | 0.035 |
| 73/06/03 | 09 30 | | 0.150 | 1.100 | 0.037 | 0.014 | 0.035 |
| 73/06/23 | 15 15 | | 0.176 | 0.560 | 0.015 | 0.014 | 0.040 |
| 73/07/10 | 11 30 | | 0.130 | 0.660 | 0.040 | 0.005K | 0.037 |
| 73/07/28 | 09 25 | | 0.098 | 0.480 | 0.026 | 0.022 | 0.045 |
| 73/07/30 | 14 50 | | 0.063 | 0.700 | 0.017 | 0.015 | 0.035 |
| 73/09/29 | 11 30 | | 0.082 | 0.400 | 0.026 | 0.026 | 0.050 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2659A3 L5265VA3
43 16 30.0 086 12 30.0
MUSKEGON RIVER
29 15 TWIN LAKE
17 MUSKEGON LAKE
NORTH CHANNEL 1.5 MI E NORTH MUSKEGON
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/24 | 10 55 | | 0.084 | 0.450 | 0.046 | 0.009 | 0.031 |
| 72/12/03 | 10 09 | | 0.200 | 2.400 | 0.695 | 0.011 | 0.022 |
| 73/01/07 | 13 50 | | 0.399 | 0.500 | 0.025 | 0.014 | 0.026 |
| 73/02/04 | 08 45 | | 0.378 | 0.500 | 0.040 | 0.014 | 0.030 |
| 73/03/04 | 09 20 | | 0.440 | 0.900 | 0.676 | 0.018 | 0.050 |
| 73/04/06 | 14 07 | | 0.147 | 0.500 | 0.019 | 0.007 | 0.020 |
| 73/04/27 | 10 05 | | 0.079 | 0.540 | 0.008 | 0.008 | 0.030 |
| 73/05/15 | 09 50 | | 0.052 | 0.650 | 0.007 | 0.009 | 0.030 |
| 73/06/03 | 09 40 | | 0.140 | 1.150 | 0.048 | 0.024 | 0.045 |
| 73/06/23 | 15 25 | | 0.186 | 1.260 | 0.046 | 0.026 | 0.050 |
| 73/07/10 | 11 40 | | 0.130 | 0.450 | 0.017 | 0.007 | 0.040 |
| 73/07/28 | 09 15 | | 0.013 | 0.500 | 0.023 | 0.011 | 0.055 |
| 73/07/30 | 14 30 | | 0.065 | 0.820 | 0.039 | 0.011 | 0.035 |
| 73/09/29 | 12 25 | | 0.054 | 0.340 | 0.023 | 0.025 | 0.050 |

STORET RETRIEVAL DATE 75/02/04

265981 LS265981
43 15 00.0 086 19 00.0
GREEN CREEK
26 15 LAKE HARBOR
T/MUSKEGON LAKE
BRDG 1.5 MI W N MUSKEGON STP DISC TO LK
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 11 25 | | 0.150 | 1.050 | 0.115 | 0.006 | 0.022 |
| 72/12/03 | 10 35 | | 0.300 | 2.730 | 0.144 | 0.008 | 0.018 |
| 73/02/04 | 09 30 | | 0.300 | 0.360 | 0.052 | 0.006 | 0.015 |
| 73/03/04 | 09 50 | | 0.340 | 0.585 | 0.064 | 0.007 | 0.025 |
| 73/04/06 | 15 20 | | 0.220 | 1.656 | 0.060 | 0.006 | 0.015 |
| 73/04/27 | 10 45 | | 0.120 | 0.610 | 0.029 | 0.011 | 0.055 |
| 73/05/15 | 09 15 | | 0.140 | 0.840 | 0.069 | 0.007 | 0.025 |
| 73/06/03 | 10 50 | | 0.086 | 0.740 | 0.084 | 0.025 | 0.055 |
| 73/06/23 | 15 50 | | 0.022 | 2.800 | 0.060 | 0.022 | 0.080 |
| 73/07/10 | 11 00 | | 0.029 | 0.590 | 0.032 | 0.008 | 0.030 |
| 73/07/28 | 08 45 | | 0.010K | 0.520 | 0.027 | 0.016 | 0.030 |
| 73/07/30 | 08 45 | | 0.013 | 0.540 | 0.022 | 0.017 | 0.030 |
| 73/09/29 | 09 45 | | 0.072 | 0.500 | 0.105 | 0.013 | 0.035 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2659C1 Ls2659C1
43 14 30.0 086 18 00.0
NEAR LAKE OUTLET
26 15 LAKE HARBOR
T/MUSKEGON LAKE
ST HWY 213 BRDG SW NORTH MUSKEGON
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 11 15 | | 0.104 | 1.350 | 0.080 | 0.006 | 0.048 |
| 72/12/03 | 10 28 | | 0.273 | 10.000 | 0.410 | 0.014 | 0.050 |
| 73/02/04 | 09 15 | | 0.430 | 0.630 | 0.130 | 0.010 | 0.030 |
| 73/03/04 | 09 45 | | 0.450 | 0.660 | 0.147 | 0.006 | 0.030 |
| 73/04/06 | 15 00 | | 0.270 | 0.630 | 0.042 | 0.010 | 0.040 |
| 73/04/27 | 10 25 | | 0.017 | 0.740 | 0.009 | 0.006 | 0.045 |
| 73/05/15 | 09 25 | | 0.010K | 0.600 | 0.005K | 0.006 | 0.050 |
| 73/06/03 | 10 40 | | 0.012 | 1.700 | 0.037 | 0.007 | 0.040 |
| 73/06/23 | 15 45 | | 0.011 | 2.400 | 0.035 | 0.010 | 0.070 |
| 73/07/10 | 11 10 | | 0.015 | 1.320 | 0.023 | 0.008 | 0.090 |
| 73/07/28 | 09 00 | | 0.294 | 1.500 | 0.035 | 0.023 | 0.107 |
| 73/07/30 | 08 00 | | 0.010K | 1.320 | 0.105 | 0.026 | 0.095 |
| 73/09/24 | 09 55 | | 0.013 | 0.780 | 0.032 | 0.010 | 0.065 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

265401 LS265401
43 15 00.0 086 13 30.0
FOURMILE CREEK
26 15 MUSKEGON
T/MUSKEGON LAKE
CITY BRDG W US31 BRDG N EDGE MUSKEGON
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 10 40 | | 1.070 | 0.700 | 0.147 | 0.210 | 0.260 |
| 72/12/03 | 09 58 | | 0.300 | 1.470 | 0.140 | 0.132 | 0.160 |
| 73/01/07 | 13 28 | | 1.780 | 1.600 | 0.220 | 0.147 | 0.170 |
| 73/02/04 | 09 00 | | 1.640 | 1.000 | 0.160 | 0.084 | 0.150 |
| 73/03/04 | 09 05 | | 1.420 | 0.660 | 0.120 | 0.130 | 0.165 |
| 73/04/06 | 14 41 | | 1.220 | 0.540 | 0.037 | 0.140 | 0.175 |
| 73/04/27 | 09 50 | | 0.850 | 0.635 | 0.072 | 0.240 | 0.280 |
| 73/05/15 | 10 05 | | 0.730 | 0.710 | 0.087 | 0.200 | 0.230 |
| 73/06/03 | 10 30 | | 0.115 | 1.150 | 0.132 | 0.260 | 0.380 |
| 73/06/23 | 15 00 | | 0.072 | 0.600 | 0.140 | 0.354 | 0.410 |
| 73/07/11 | 08 30 | | 0.014 | 0.750 | 0.168 | 0.420 | 0.560 |
| 73/07/29 | 09 45 | | 0.013 | 1.100 | 0.150 | 0.330 | 0.385 |
| 73/08/27 | 09 55 | | 0.010K | 0.585 | 0.180 | 0.378 | 0.470 |
| 73/09/29 | 11 45 | | 0.560 | 0.230 | 0.078 | 0.280 | 0.315 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

26539E1 LS26539E1
43 14 30.0 086 14 30.0
BYERSON CREEK
26 15 MUSKEGON
1/MUSKEGON LAKE
AT US 16 BRDG IN MUSKEGON
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 10 30 | | 1.400 | 1.750 | 0.420 | 0.072 | 0.170 |
| 72/12/03 | 11 05 | | 0.420 | 2.600 | 0.540 | 0.087 | 0.140 |
| 73/01/07 | 11 32 | | 2.100 | 1.200 | 0.530 | 0.073 | 0.100 |
| 73/02/04 | 10 15 | | 1.620 | 1.380 | 0.054 | 0.020 | 0.110 |
| 73/03/04 | 10 30 | | 1.520 | 1.200 | 0.320 | 0.066 | 0.110 |
| 73/04/06 | 15 40 | | 1.520 | 1.750 | 0.315 | 0.058 | 0.110 |
| 73/04/27 | 11 25 | | 1.360 | 0.880 | 0.231 | 0.065 | 0.130 |
| 73/05/15 | 12 00 | | 1.440 | 1.100 | 0.290 | 0.088 | 0.160 |
| 73/06/03 | 13 15 | | 0.890 | 0.950 | 0.200 | 0.154 | 0.270 |
| 73/06/23 | 16 45 | | 1.220 | 1.800 | 0.378 | 0.100 | 0.200 |
| 73/07/11 | 08 45 | | 0.730 | 0.960 | 0.270 | 0.147 | 0.260 |
| 73/07/29 | 10 00 | | 1.200 | 0.900 | 0.265 | 0.087 | 0.185 |
| 73/08/27 | 07 05 | | 1.200 | 0.880 | 0.345 | 0.105 | 0.170 |
| 73/09/29 | 12 00 | | 1.480 | 0.940 | 0.410 | 0.068 | 0.175 |

STORET RETRIEVAL DATE 75/02/04

2659F1 LS2659F1
43 13 00.0 086 17 00.0
KOOIMAN CREEK
26 15 LAKE HARBOR
T/MUSKEGON LAKE
LAKESHORE DRIVE BRDG W EDGEMUSKEGON
11EPALES 2111204
4 0000 FEET DEPTH

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 72/10/29 | 10 00 | | 0.420 | 0.900 | 0.370 | 0.105 | 0.160 |
| 72/12/03 | 09 40 | | 0.260 | 1.320 | 0.290 | 0.115 | 0.180 |
| 73/01/07 | 14 40 | | 1.440 | 1.260 | 0.410 | 0.126 | 0.250 |
| 73/02/04 | 08 00 | | 1.620 | 2.940 | 0.460 | 0.150 | 0.270 |
| 73/03/04 | 08 45 | | 1.680 | 2.200 | 0.430 | 0.230 | 0.360 |
| 73/04/06 | 13 00 | | 0.890 | 1.600 | 0.210 | 0.048 | 0.130 |
| 73/04/27 | 14 05 | | 0.780 | 1.650 | 0.115 | 0.021 | 0.140 |
| 73/05/15 | 11 30 | | 1.020 | 1.000 | 0.160 | 0.014 | 0.080 |
| 73/06/03 | 11 30 | | 0.720 | 1.890 | 0.016 | 0.019 | 0.150 |
| 73/06/23 | 14 35 | | 0.550 | 1.470 | 0.190 | 0.081 | 0.225 |
| 73/07/10 | 16 40 | | 0.240 | 1.700 | 0.061 | 0.029 | 0.140 |
| 73/07/29 | 09 25 | | 0.410 | 1.000 | 0.100 | 0.048 | 0.145 |
| 73/09/29 | 12 30 | | 0.590 | 0.840 | 0.060 | 0.032 | 0.135 |